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SILVICAL CHARACTERISTICS of NOBLE FIR

by GEORGE R. STAEBLER

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SILVICAL CHARACTERISTICS OF NOBLE FIR

by

George R. Staebler[1/]

Noble fir (Abies procera)[2/] has many common names, but none is more apt than the accepted name, noble, referring to its stately appearance in the mixed forest in which it grows (fig. 1). The scientific name procera, derived from the Latin procerus, meaning tall, is likewise descriptive of the tree. Red fir and white fir are other common names (14),[3/] the latter being used in the lumber trade. Noble fir lumber, which is superior to that of other true firs, has also been extensively marketed as "larch" to overcome the general prejudice against the wood of Abies.

The wood is used for flooring, interior finish, doors, window sash, boats, crates, and boxes. It is also being cut increasingly for veneer to be used in plywood. Present commercial volume of noble fir stumpage in Washington and Oregon is estimated to exceed 15 billion board-feet.

Noble fir is restricted in its natural range to the mountains of the Pacific Northwest (fig. 2). On the eastern slope of the Cascade Range, it occurs north of about latitude 45 degrees and only at higher elevations. On the west side of the Cascades, where it is most abundant, and in the Coast Range, where it occurs sparsely, it grows between 1,400 and 6,000 feet elevation, extending in the Cascades from the Canadian border to northern California. In the Coast Range, it is found only in southwest Washington and northwest Oregon.

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2/ Scientific and common names of trees in this publication follow: Check list of native and naturalized trees of the United States (including Alaska) (14).

3/ Underscored numbers in parentheses refer to Literature Cited.

Figure 1.--Three large noble firs, 5 to 7 feet in diameter, growing in a mixed forest in Cowlitz County, Wash. Large trees on the right are Douglas-fir and western hemlock. (Photo courtesy of Weyerhaeuser Timber Co.)

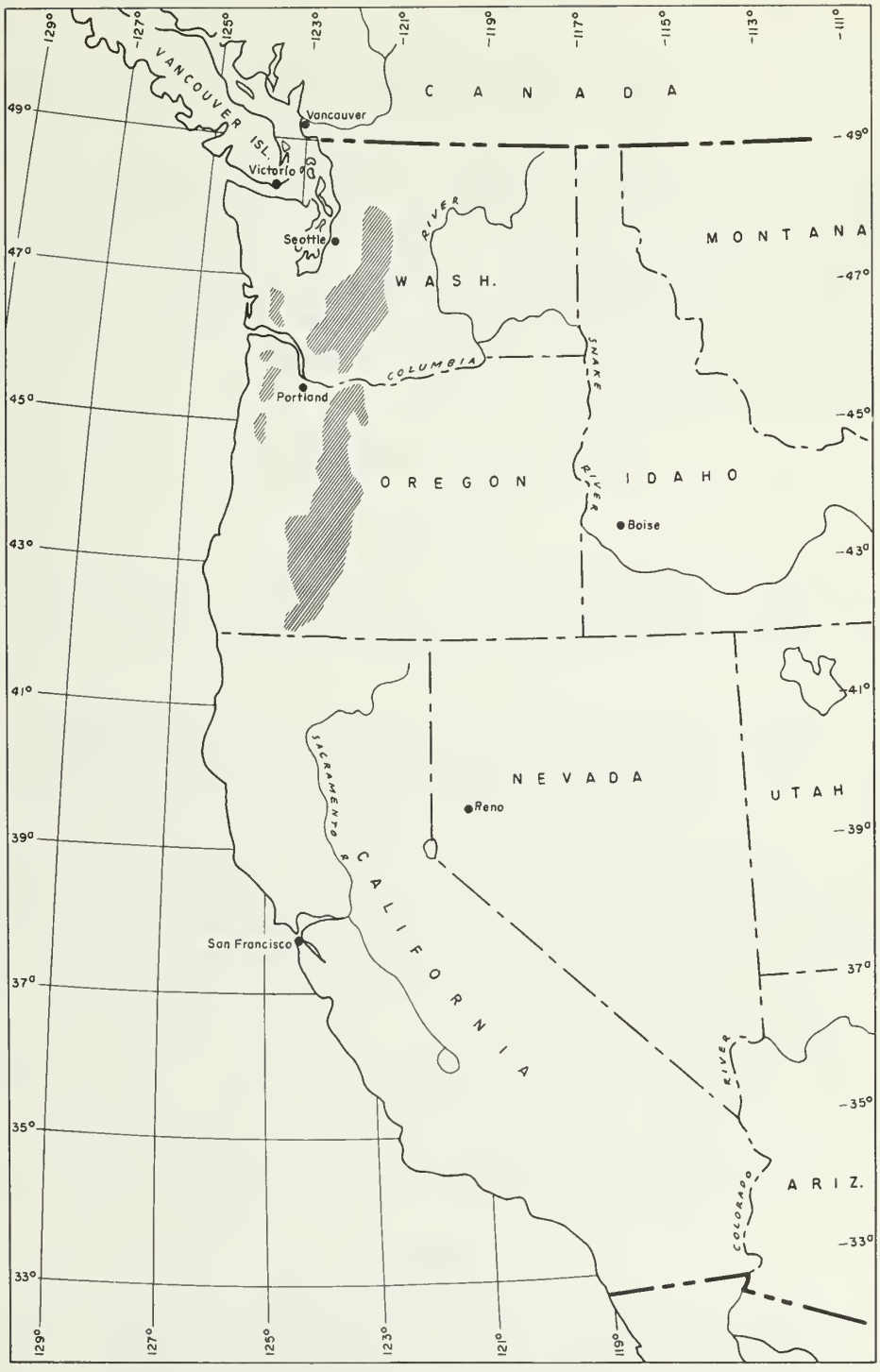

Figure 2.--Range of noble fir.

Exact limits of the tree's range are still unknown, and conflicting reports are more the rule than the exception. For the north Cascades, most published distributions list the tree as occurring on the slopes of Mt. Baker. Muenscher (17), however, states that he did not find it anywhere in Whatcom County (which includes Mt. Baker). In the southern Cascades it is apparently rare south of the Oregon-California line, though reported as far south as Mt. Lassen in California (6). In the Coast Range, Sargent (19) reported finding a single specimen at 3,000 feet in the Soleduck River drainage on the north side of the Olympic Mountains of Washington, and Sudworth (22) reports noble fir as occurring generally above 3,000 feet in this area. A later observer, however, was unable to confirm its presence anywhere on the Olympic Peninsula (12).

HABITAT CONDITIONS

Climatic

The range of noble fir lies almost entirely in the superhumid climatic zone as delineated by Thornthwaite (23), but with considerable extension into areas classed as humid.

Generally, noble fir occurs in areas of mild climate characterized by abundant annual precipitation, but low growing-season rainfall. In the Coast Range, much of the precipitation occurs as rainfall, whereas in the Cascades a high proportion falls as snow.

Complete weather data are scarce from stations within the altitudinal range of noble fir. There are no stations at all in the Coast Range at the needed elevations. Available data from 7 selected stations between 1,500 and 4,000 feet in the Cascades (10, 24, 26) indicate a range in annual precipitation from 70 to 103 inches, of which only a fifth to a fourth falls during the April-September period (table 1). Annual snowfall varies from about 80 to 480 inches. Average temperatures during January range from 24° to 35° F., and during July from 57° to 62° F. Absolute maximum and minimum temperatures for 6 of the 7 stations are 105° and -17° F.

Edaphic

Noble fir grows on a wide range of soils if ample moisture is available. Like most tree species, optimum development occurs on deep, fertile soils on benches and lower slopes. Noble fir is not known as an exacting species, however, and trees reach commercial size on relatively poor, thin soils. Water supply is more critical than soil quality (22).

Table 1.--Climatological data for selected stations between 1,500 and 4,000 feet elevation in Oregon and Washington[1/]

Station and altitude (feet)	Average precipitation			Temperature					Frost-free period[2/]
				Average			Absolute		
	Apr.-Sept.[3/]	An.[3/]	Annual snowfall	An.	Jan.	July	Max.	Min.	
	Inches			Degrees F.					Days
Washington:									
Snoqualmie Pass (3,020)	20.7	94.7	386	41.6	25.9	57.8	101	-17	-
Cedar Lake (1,560)	28.8	103.3	79	48.6	35.2	62.1	98	-11	201
Longmire (2,762)	18.6	76.9	168	44.6	30.2	60.6	105	- 8	134
Spirit Lake (3,240)	20.1	86.5	239	42.4	29.6	58.9	97	-15	136
Stampede Pass (3,963)	21.6	93.6	483	39.9	23.7	56.9	86	-11	-
Oregon:									
Government Camp (3,890)	22.3	84.6	-	42.3	30.3	56.0	96	-16	-
Sundown Ranch (2,350)	18.4	69.8	-	48.5	-	-	-	-	-

[1/] Oregon data from "Better Douglas-fir forests from better seed" (10) and the 1941 Yearbook of Agriculture, "Climate and Man" (24). Washington data from U. S. Weather Bureau records (26).

[2/] Period between last temperature of 32° F. in the spring and first temperature of 32° F. in the fall.

[3/] Including water equivalent of solid forms.

Physiographic

Noble fir is essentially a tree of the mountains. In the Cascades it grows almost exclusively in the Canadian Life Zone of Merriam's classification (16). In Mount Rainier National Park on the west edge of the Cascades, the Canadian Zone lies between 3,000 and 5,000 feet (5). Most of the Coast Range where noble fir grows lies in the Humid Transition Zone (18); the Canadian Zone occurs only on the higher peaks (3). However, at higher elevations the two zones are difficult to distinguish (12). Factors controlling the limits of the Canadian Zone apparently also account for the occurrence of

noble fir, as described by Sudworth (22): "Vertical range increases from north to south and from coast eastward within a more or less fixed zone of heat and moisture."

Noble fir is not limited to any aspect nor to any specific topographic location.

Biotic

Noble fir is a minor component of five recognized forest types (20). In no type is it the predominant species. A "noble fir type" is not recognized by the Society of American Foresters Committee on Forest Types, because of its very limited occurrence. At high elevations, noble fir is a minor component of the mountain hemlock--subalpine fir type. Somewhat lower, it is a component of the Pacific silver fir--hemlock type, which probably contains the bulk of the world's noble fir. It is also found in the western hemlock, Pacific Douglas-fir, and Douglas-fir--western hemlock types where these types occur at sufficient altitude.

The Pacific silver fir--hemlock type merges into the red fir type in central Oregon. In the resulting transition zone, ranges of the ecologically similar noble fir and California red fir (Abies magnifica) overlap. Taxonomic distinction of the two firs is difficult in this area.

Characteristically, then, noble fir occurs in mixture with other conifers in its range, and rarely in pure stands of any size. No animal or plant associates can be said to be "typical" throughout the range of the species.

LIFE HISTORY

Seeding Habits

Dates of flowering and bud bursting have seldom been recorded for noble fir. In 1956, observation in a single area[4/] at 3,500 feet elevation in Clark County, southwestern Washington, showed that buds burst between the 12th and 15th of May. Staminate flowers appeared first, then pistillate flowers, followed by new vegetative

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[4/] Larch Mt., Section 27, T. 3 N., R. 4 E., W.M.; Charles Briggs, Washington State Dept. of Natural Resources, observer.

growth. Events were earlier by several days at 2,500 feet. The 1956 spring should be characterized as normal or slightly early. The average temperature at Vancouver (elevation 100 feet) was 1.6 degrees above normal in April, and 3.5 degrees above normal in May. Both months were drier than normal (26).

In 1957, noble fir at 4,500 feet elevation in King County, central western Washington, shed pollen during the week of May 27.[5/]

Cones ripen in early September and break up and disperse their seed in October. Although trees 20 to 30 years old may bear cones, seed production more commonly begins when trees are from 50 to 60 years old and increases with age. Cones collected from 30-year-old trees on the Snoqualmie National Forest yielded seed of very low viability. Good seed crops are borne infrequently, although some seed is produced every year. Sudworth (22) classes the tree as a moderately prolific seeder.

The seed is comparatively heavy, averaging 14,600 per pound. Germinative capacity is near the bottom of the list for species of Abies, averaging only 24 percent (ranging from 2 to 72 percent) in 7 trials (25).

In Isaac's seed flight tests (9), 73 percent of the winged seed released at 200 feet in an 11-m.p.h. wind fell 1,400 feet or less from the point of release, with greatest fall, 21 percent, at 1,400 feet. Maximum seed flight was 2,200 feet. These distances are about the same as for Douglas-fir (Pseudotsuga menziesii). Seed recovered at 1,400 feet was of about average soundness, whereas that recovered at greater distances was less than average.

Cones and seeds are attacked by a cone moth (Dioryctria abietella) and a seed chalcid (Megastigmus pinus) (13). Several species of gall midges belonging to the family Itonididae also infest the cones. In addition, much of the seed is taken by squirrels and other rodents.

[5/] Section 11, T. 19 N., R. 10 E., W.M.; John Rediske, Weyerhaeuser Timber Co., and John Duffield, Industrial Forestry Assoc., observers.

Seedling Development

The first deterrent to the success of noble fir regeneration is poor germinative capacity of the seed, already mentioned.

In the altitudinal range of the species, snow often covers the ground before seed is disseminated. Some seed may germinate the following spring, while still in a snowbank (21). Although such seedlings have little or no chance for survival, the phenomenon is apparently not sufficiently common to seriously hinder natural regeneration.

Seeds germinate freely and seedlings grow well on any moist humus or mineral soil in the open or in moderate shade (7, 22). Experience in Scotland indicates that equal mixtures of raw humus and moss make a good seedbed for noble fir and other Northwest conifers (15).

Studies by Wilcox (27) show that the main root of noble fir is slow growing, whereas lateral roots develop rapidly but with few branches. Root systems of typical 1- to 3-year-old seedlings are not fibrous in appearance and do not have a well-developed tap root. Failure to develop a tap root early may explain why seedlings survive only in moist situations. Wilcox has also shown (28) that root pruning does not result in a compact, fibrous root system since the number of laterals is not increased. Instead, replacement of severed roots takes place at the pruned surface. The elongated roots thus regenerated are easily lost in transplanting.

Sapling Stage to Maturity

Noble fir is a slow starter. Hanzlik's data (7) show that seedlings require 3 to 4 years to reach a height of 1 foot, and 11 years to reach breast height. Following the juvenile stage, however, height growth is rapid and the tree is fully able to compete with its associates.

Where noble fir occurs in mixed stands it is always a component of the upper crown canopy. The fact that it maintains this position is evidence that its height growth is equal to or better than that of its associates.

Hanzlik's study (7) showed that in a 400-year-old mixed stand of Douglas-fir, western hemlock (Tsuga heterophylla), and noble fir, dominant trees of all species had followed about the same diameter growth pattern. At 120 years the trees averaged about 24 inches in diameter.

Noble fir is probably the longest lived of the true firs, but its extreme age is unknown. The largest tree on record is 87 inches in diameter and 260 feet tall (1). Trees approaching this size are undoubtedly 600 to 700 years old. The average noble fir in the 400-year-old northern Oregon stand that Hanzlik studied was 4 feet in diameter and 200 feet tall.

Noble fir is classed as an intolerant tree (2). Unlike other Abies it is not found as a subdominant in an established stand. Even in the juvenile stage it is so light demanding that reproduction rarely survives beneath older stands. Hanzlik (7) considers it equal to Douglas-fir in its light requirements.

Since noble fir does not ordinarily grow in pure stands, yield information is meaningless. Analysis of 11 timber sales covering 3,056 acres on the Snoqualmie National Forest in Washington, mostly in the Pacific silver fir--hemlock type, showed that the stands averaged 49,500 board-feet per acre. Noble fir made up from 2 to 44 percent of the stands by volume, averaging 18 percent. On one sale of 35 acres, the cut averaged 108,600 board-feet per acre, of which 38 percent was noble fir. These stands were all estimated to be from 250 to 300 years old.

Although seldom occurring in pure stands in the natural state, there appears to be no ecological reason why it shouldn't thrive under such conditions. Hanzlik (8) has said that pure stands of noble fir should produce as well as Douglas-fir on similar sites.

Three of the forest types in which noble fir occurs are climax types: Pacific silver fir--hemlock, mountain hemlock--subalpine fir, and western hemlock. The other two types in which noble fir is found, Pacific Douglas-fir and Douglas-fir--western hemlock, are subclimax (18). Since noble fir does not reproduce readily in the shade of the old-growth forest, it appears that the proportion of noble fir in climax forest types must become less and less, except where the climax type reproduces itself following destruction or removal of the previous forest. This, coupled with chance distribution of species in the reproduction, probably accounts for the wide variation in the amount of noble fir found in mature stands.

Insect and disease enemies of noble fir are not serious. Keen (13) lists only one insect that may kill the tree, the noble fir bark beetle (Pseudohylesinus nobilis). Other insects that may attack the living tree are the flatheaded fir borer (Melanophila drummondi),

the balsam woolly aphid (Chermes piceae), two roundheaded borers (Tetropium sp. and Poliaenus oregonus), and a twig beetle (Pityophthorus pseudotsugae). The balsam woolly aphid, which is so destructive to Pacific silver fir (Abies amabilis) and subalpine fir (A. lasiocarpa), has only recently been reported on noble fir growing under forest conditions (11). In the forest, noble fir appears much less susceptible than other Abies to woolly aphid attack.

The tree is also comparatively disease free. Boyce (4) lists only two trunk rots that may occur on noble fir: red ring rot, caused by Fomes pini, and a brown stringy rot, caused by Echinodontium tinctorium. At least one butt-rotting fungus and a number of needle casts and rusts are known to attack noble fir, but none are considered serious.

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